COMMONWEALTH OF AUSTRALIA

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Warning

CHARLES DARWIN UNIVERSITY

Family Name	
Given Names	
Student Number	
Teaching Period	Semester 2, 2016

FINAL EXAMINATION	**DURATION**
ENG267 – Hydraulics and Soil Mechanics	Reading Time: **10** minutes Writing Time: **120** minutes

INSTRUCTIONS TO CANDIDATES

EXAM CONDITIONS

You may begin writing from the commencement of the examination session. The reading time indicated above is provided as a guide only.

This is a CLOSED BOOK examination

Any non-programmable calculator is permitted

No handwritten notes are permitted

No dictionaries are permitted

ADDITIONAL AUTHORISED MATERIALS	**EXAMINATION MATERIALS TO BE SUPPLIED**
No additional printed material is permitted	1 x 16 Page Book 1 x Scrap Paper

THIS EXAMINATION IS PRINTED DOUBLE-SIDED.

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SECTION A

Each question worth 4 marks (Total Marks 40)

Wherever possible use sketches and diagrams to explain your answer.

Q.1
What is Plasticity Index? What does that indicate as regard to the property of soil**?**

Q. 2
Explain briefly how we classify a soil.

Q. 3
5 kg of soil is at natural water content of 3.5%. If you add additional 0.65kg of water to the soil what will be the new water content?

Q. 4
In a sandy terrain, the water table lies at a depth of 3.5m below ground level. Bulk and saturated unit weights of the sand are 16.5kN/m^3 and 18.5kN/m^3 respectively. What is the effective vertical stress at 10m depth?

Q. 5
What is relative density? Explain use of application in soil mechanics.

Q. 6
Explain piping in granular soils.

Q. 7
With the aid of a diagram explain the different types of subsurface water can be found under a surface.

Q. 8
What is a seepage force?

Q9
What is an equipotential line in flow network?

Q10
Estimate the capillary rise in a sandy silt where D_{10} = 0.032mm.

SECTION B (Total Marks 60)

Q. 1 (15 Marks)
The following index properties were determined for two soils X and Y

Property	X	Y
Liquid Limit	0.62	0.34
Plastic limit	0.26	0.19
Water content	38%	25%
Specific gravity	2.72	2.67
Degree of saturation	1.00	1.00

Which of this soils (a) contains more clay particles (b) has a greater wet density (c) has greater dry density (d) has greater void ratio?

Give reasons for your answers with appropriate calculations.

Q. 2 (15 Marks)
The result of a compaction test is given below. Plot a graph of dry density vs. Water content and determine the optimum water content. If at 10% water content, a heavier roller was available, should it be used on the soil?

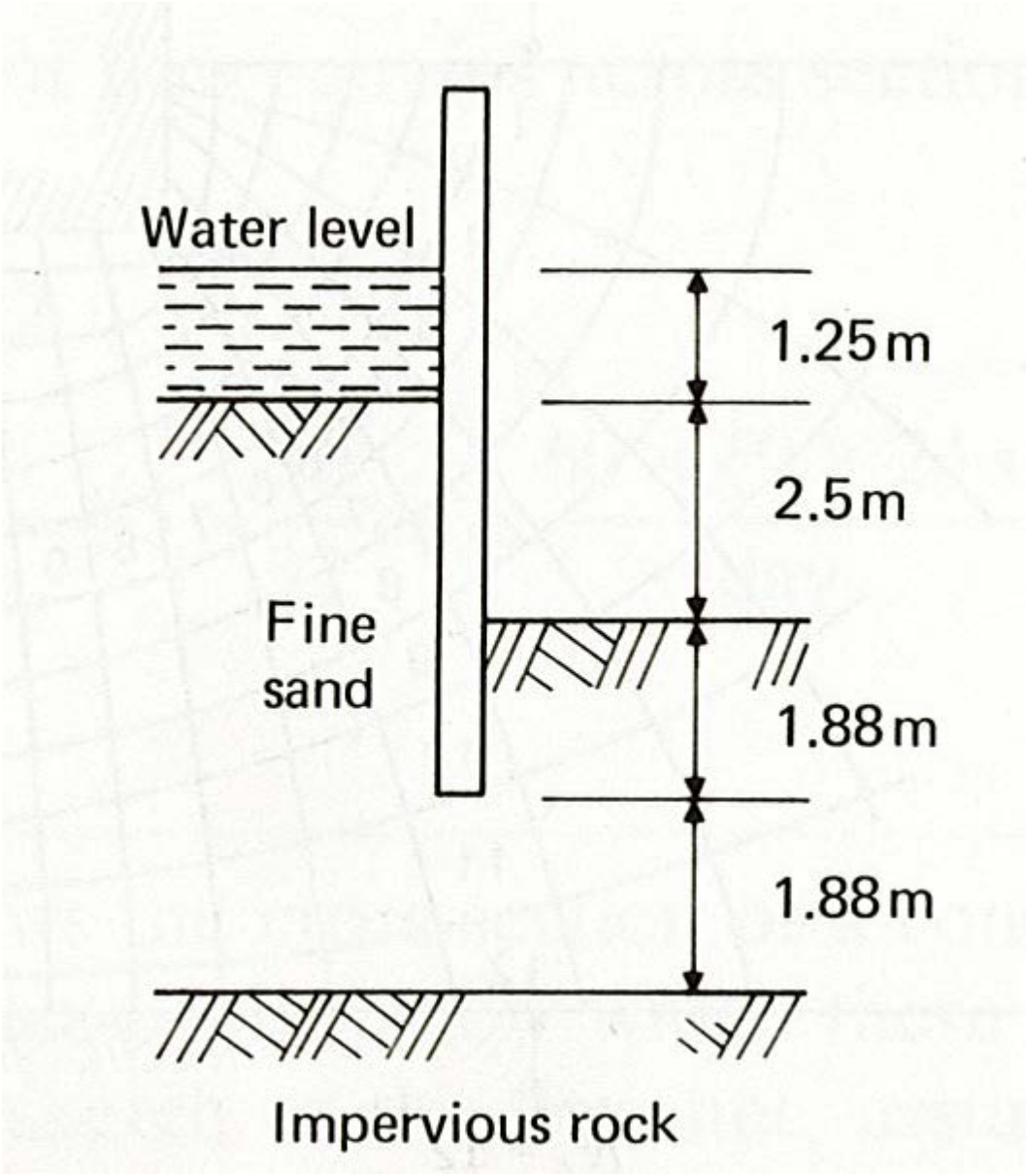
Water content (%)	Bulk Density (Mg/m^3)
6.7	2.06
8.6	2.14
9.4	2.17
10.2	2.21
11.4	2.22
12.5	2.21
13.5	2.18

Q. 3 (15 Marks)
(a)
In a constant head Permeameter test the following results are obtained. Calculate the coefficient of permeability of the sample.

Diameter of Permeameter = 70mm
Loss of head on a length of 200mm = 80mm
Water collected in 1 min = 66ml

(b)
In the field, a pumping out test can be carried out to determine the permeability of the soil in situ. Briefly describe the test and the theory involved.

Q. 4 (15 Marks)
Make a rough sketch of a flow net of seepage under the sheet piling shown below. Estimate approximately the quantity of seepage in m^3/min/m run of piling if the permeability of the sand is 18×10^{-3}mm/s.



ENG267-Hydraulics and Soilmechanics
Formula Sheet for Soil

Void ratio $e = V_v/V_s$
Porosity $n = V_v/V_t$
$h_c = 0.15/D_{10}$
Degree of Saturation $S = (V_W/V_v) \times 100\%$
Moisture content $w = (M_w/M_s) \times 100\ \%$
Porosity $n = e/(1+e)$
Bulk Density $p_b = p_w(G_S+eS_r)/(1+e)$
Dry Density $p_d = (p_w G_s)/(1+e) = p_b/(1+w)$
Saturated Density $p_{sat} = ((G_s+e)/(1+e))p_w$
Water Content $w = (se)/G_s$
$K = (QL)/(Ah_L)$
$K = ((al)/(At))\ln(h1/h_2)$
$K = (Q/\pi(h_2^2-h_1^2))\ln(r2/r_1)$
$Q = kh_L(N_f/N_d)(a/b)$